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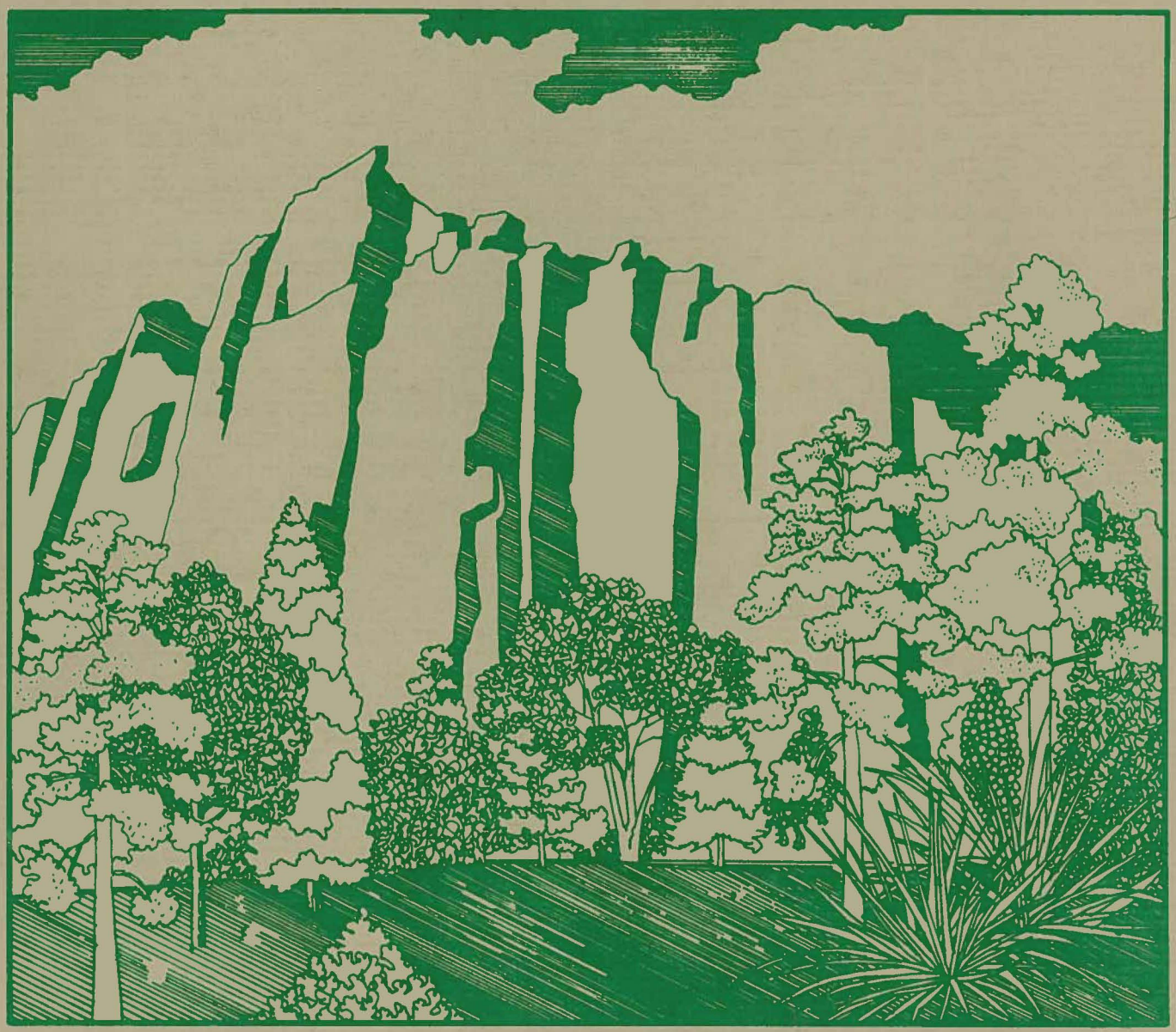
R-3 90-10

BIOLOGICAL EVALUATION OF PEST CONDITIONS AND POTENTIAL HAZARD TREES IN FOUR SELECTED RECREATION SITES ON THE SANTA FE NATIONAL FOREST NEW MEXICO

MAY 1990



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BIOLOGICAL EVALUATION OF PEST CONDITIONS AND POTENTIAL HAZARD TREES IN FOUR SELECTED RECREATION SITES ON THE SANTA FE NATIONAL FOREST NEW MEXICO

MAY 1990

By

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ABSTRACT

In 1989, Forest Pest Management in Region 3 initiated an Insect and Disease Incidence Survey Program of recreation sites. The purpose of this program is to evaluate the overall "health" of proposed and existing recreation areas on the National Forests in the Southwest. Jim Bedwell, Recreation and Lands Staff, provided a list of areas to be surveyed on the Santa Fe National Forest. One campground was surveyed on the Espanola and Jemez Ranger Districts (RD) and two campgrounds were surveyed on the Cuba RD. This report summarizes the hazardous trees and the insect and disease pest conditions found during these surveys. Specific areas surveyed (Figures 1, 3, 4, and 5 included:

Espanola RD	Jemez RD	Cuba RD
Black Canyon CG	Redondo CG	Rio Las Vacas CG
		Clear Creek CG

The information provided in this report offers pest management considerations that can be used to develop vegetation management plans.

OBJECTIVES

The objectives of this survey were to: (1) Identify hazardous trees occurring within these developed recreation sites, and (2) evaluate the incidence of insect and disease pest activity and damages in recreation sites scheduled for reconstruction.

SURVEY DESIGN

The procedures followed are described in the "Inventory of Insects, Disease, and Hazard Tree Incidence Work Plan for Developed Recreation Sites on National Forest System Lands in the Southwest" (Rogers, 1989). This survey consists of two parts; a hazard tree survey and an insect and disease pest incidence survey. A hazard tree is defined as any tree with a structural defect that could cause the tree to fail and a potential target (table, campsite, parking pad, toilet facility, etc.). Only trees located in areas of intensive public use and showing signs of structural defect (dead top and/or branches, bole rot, and exposed roots, etc.) were evaluated. Tree species, diameter inside bark (DIB), location, defect, and hazard tree rating were recorded on the Hazard Tree Evaluation Forms (Appendix) and plotted on the site design maps provided by Recreation Management, Regional Office (Appendix).

The hazard tree rating system is patterned on the procedures described by Johnson (1981) and involves the factors that contribute to tree failure such as dead limbs and weak forks, degree of lean and signs of insect and disease-caused damages. This system involves a two-part Failure/Risk rating, each part using a descriptive rating scale of High (H), Medium (M), and Low (L) to estimate probability. The first part of this rating system is an estimate of the probability that the tree, or major portions thereof, will fail within the next five years; the second part is an estimate of the probability that the failed tree, or portions thereof, will cause personal injury or property damage if failure does occur. Only trees located in areas more likely to be occupied by people or property were evaluated and recorded on the evaluation forms.

The insect and disease pest incidence survey was a 100 percent tree survey conducted concurrently with the hazard tree evaluation survey. The following data were collected for each tree exhibiting signs of insect, disease, and abiotic damages: Species, diameter at breast height (DBH), tree history, damage code, and a dwarf mistletoe rating (DMR) (Hawksworth, 1977).

RESULTS AND DISCUSSION

A total of 42 hazard trees were recorded in the four recreation sites surveyed. Of these, approximately half (20) were rated in the high risk category (H/H). All of the rated trees were either dead (40 trees) or showing advanced stages of decline (2 trees). The majority of the high risk hazard trees also had structural defects caused by decay fungi and were either located near permanent structures (buildings, tables, etc.) or areas of public access. Most of the category 1 trees (H/H) are expected to fail sometime within the next five years. The number of hazard trees in each rating category or class are summarized in Table 1 below. Specific information on these defective hazard trees and their locations are provided on the Tree Hazard Evaluation Forms (Appendix). The approximate location of the hazard trees are plotted on the attached site design maps (Figures 1, 3, 4, and 5, Appendix).

Table 1. Summary of hazard trees by rating class for each recreation site surveyed on the Santa Fe National Forest.

Campground	Number of Trees with Rating of: H/H[a]	H/M	M/H	H/L	Total
Espanola RD					
Black Canyon CG	17	19	1	1	38
Jemez RD					
Redondo CG	1	0	0	0	1
Cuba RD					
Rio Las Vacas CG	2	0	0	0	2
Clear Creek CG	0	0	1	0	1
Total	20	19	2	1	42

CG = Campground

[a] Failure/ Risk Rating: H = high; M = Medium; L = Low

The hazard tree ratings provided are not recommendations for action. They are a professional estimate of the probability of tree failure within the next 5 years and should be used by the land manager during the decision-making process when developing management plans for these recreation areas. Attention should be given to category 1 trees (H/H), since they are the most prone to failure and present the greatest risk of personal injury and property damage. Trees with moderate and low failure ratings need no immediate action, but should be monitored for changes over the years. Following is a brief description of the campground vegetation and the pest and hazard tree conditions found at each of the four recreation sites surveyed.

Black Canyon CG (Espanola RD). This campground is located within the transition zone between the ponderosa pine and mixed conifer vegetation types. The overstory consists primarily of ponderosa pine or white fir, Douglas-fir and aspen depending on aspect. The understory is mostly a mixture of white fir, Douglas-fir, and aspen. Some southwestern white pine and spruce are also present.

The most prominant tree damages found in this campground (Figure 2, Appendix) were caused by the aspen stem canker, Encolia pruinosa (sooty-bark canker). This canker disease is very aggressive and usually causes tree mortality within four to five years after initial infection. Twenty-six of the 42 sooty-bark canker-killed trees found in this recreation site were rated for hazard. Of these, eighteen were given a high risk rating (H/H) because at their potential for causing personal injury and/or property damage (Figure 1, Appendix). Many of these high risk trees also showed signs of severe aspen trunk rot (2 to 3 cankers of Phellinus tremulae within 16 feet of the ground) increasing the probability of their failing sometime within the next five years. Aspens heavily infected with trunk rot are particularly susceptible to wind breakage and windthrow.

Although all of the aspen mortality found in this campground was attributed to one or a combination of disease pathogens, these disease pathogens were actually secondary causes of mortality (Hinds, 1976). The primary cause of mortality was due to wounding caused by recreationists. Wounding of the soft, living aspen bark not only causes physical injury to the tree, but predisposes them to disease infection, the most damaging of which are the tree killing canker diseases. Aspens, particularly those in recreation settings, are especially prone to wounding and subsequent disease infection.

Other disease related damages found at this site included those caused by armillaria root disease, Armillaria spp. and Douglas-fir dwarf mistletoe (DFDM), Arceuthobium douglasii. Pockets of armillaria root disease, an important disease of conifers, were found at several locations in this campground (Figure 1, Appendix). An examination of 11 armillaria-killed white firs, ranging from four to ten inches in dbh, revealed the fan-shaped mycelia characteristic of this disease. Three Douglas-fir saplings (four inches in dbh) were also found with advanced symptoms of armillaria root disease infection, thin, yellowing crowns. As tree losses from this root disease continue to increase, underplanting and/or transplanting larger, less susceptible tree species from offsite may be necessary in order to retain desirable tree cover at some sites. Eight DFDM infected overstory trees were found in this campground (Figure 2, Appendix). Prompt suppression of these DFDM infected trees will reduce the rate of spread and intensification of this disease in this campground.

The only insect related damages observed in this campground were those caused by the western spruce budworm (WSB), Choristoneura occidentalis. Damages from this important defoliator of mixed conifers (white fir, Douglas-fir, and spruce) consisted primarily of severe needle loss (defoliation) and scattered topkilling of understory seedling, sapling, and pole-sized trees. However, because the WSB has recently declined to very low levels on this portion of the Forest, most of these defoliated trees are expected to recover within 2 to 3 years.

Redondo CG (Jemez RD). Redondo CG is located within a nearly pure stand of ponderosa pine. The overstory is composed of mostly overmature ponderosa pine, some of which are beginning to show signs of decline, such as flat, thinning crowns, and roots exuding pitch. However, we expect none of these trees should

pose a hazard over the next 5 years. Some of the overstory trees in this campground are heavily infected with southwestern dwarf mistletoe (SWDM), Arceuthobium vaginatum subsp. cryptopodum , and are infecting the understory, which is largely composed of susceptible ponderosa pine seedlings, saplings, and pole-sized trees (Figure 3, Appendix). Treatments to suppress SWDM infections in this campground should be evaluated. Most of the overstory trees found infected with SWDM are above the suggested limit which responds favorably to pruning (see Biology of Pests), yet the existing regeneration either needs to be protected, or replaced with nonhost species (southwestern white pine, Douglas-fir, etc.). Several pockets of armillaria root diseased-killed pine seedlings and saplings were also found near the entrance of the campground (Figure 3, Appendix). Some areas of this campground, those of north and northeast aspect, contain a mixture of white fir, Douglas-fir, and an occasional southwestern white pine or aspen. WSB defoliation damages were found on the white fir and Douglas-fir; these defoliation damages, however, were very minor consising primarily of one or two years of partial needle loss. No significant diseases were detected on these species.

One dead mountain pine beetle-killed ponderosa pine hazard tree, 22.5 inches in dbh, was found near campsite 46 (Figure 3, Appendix). Two additional MPB-killed trees were also found northwest of this campsite near the boundary of the campground. No other bark beetle activity was detected in this campground.

Rio Las Vacas CG (Cuba RD). Scattered throughout this recreation site is a dwindling overstory of mature ponderosa pine. A fairly evenaged new stand of mixed conifer (40 to 50 years old) dominates the understory. Composition of the understory varies from pine in the more open eastern half of the campground, to primarily Douglas-fir and spruce in the more densely forested areas of the campground. Much of the Douglas-fir, spruce, and occasional white fir has been moderately to heavily defoliated by the WSB. Although some areas of light to moderate WSB defoliation were detected on this District within and adjacent to the San Pedro Wilderness during our 1989 Aerial Survey, no recent defoliation damages were detected at this site during this survey.

Two hazard trees were found in this campground near campsite 5 (Figure 4, Appendix).

Clear Creek CG (Cuba RD). A few overmature ponderosa pines are scattered throughout this campground. The majority of this campground site is either open and grassy or densely forested with a 70 to 80 year stand of mixed conifer. In the densely forested areas, the primary tree component is white fir and Douglas-fir mixed with some blue spruce. These densely forested areas have been heavily defoliated by the WSB, which has resulted in some mortality and topkilling to white fir and Douglas-fir seedlings and saplings. A few overmature aspens are also scattered throughout the mixed conifer. Most of them are infected with aspen trunk rot and are declining. One of the declining aspens examined during this survey, near campsite 5 (Figure 5, Appendix), was given a moderate failure/higk risk hazard rating because of its potential for causing personal injury and/or property damage. Although the WSB is currently at very low levels and no recent defoliation damages were found during this survey, thinning the densely forested mixed conifer areas and favoring ponderosa pine where possible in this campground will reduce overall stand susceptibility and vulnerability to future WSB defoliation damages. No significant insect or disease activity was found associated with ponderosa pine.

BIOLOGY OF PESTS

Sooty-bark Canker, Encolia pruinosa.

Sooty-bark canker is named for the black residue formed under the infected bark that adheres tightly to the trunk for many years, even after tree death. This canker disease is very aggressive and can cause tree mortality within four to five years after initial infection. Spores of this fungus are formed on light-gray, cup-shaped fruiting bodies on the old, dead inner bark. This disease also occurs in association with cambial wounds and can be especially damaging to aspens in recreation areas. The fungus infects trunk wounds and penetrates the inner bark and cambium. The dead outer bark sloughs off two or three years after initial infection, exposing the blackened inner bark in an elliptical, zonate pattern.

Aspen Trunk Rot, Phellinus tremulae.

Aspen trunk rot is the most common cause of defect in aspen. Fruiting bodies or conks of this fungus are frequently found on stems of living and dead trees and often occur near branch stubs or old wounds. Conks are hoofed-shaped; the upper surface is gray to black and divided into irregular squares by numerous cracks. The interior of the conk has white flecks and a layered appearance; The color of the lower surface varies from tan to white to dark brown and has many tiny spores. Trees with more than three conks within 16 feet of the ground are severely decayed and susceptible to breakage and windthrow at any time. This decay is most common in overmature stands; however, it can also infect young trees

Armillaria root disease, Armillaria spp.

Armillaria root disease is caused by fungi which live as parasites on living host tissue or as saprophytes on dead woody material. Recent research indicates that several different, but closely related, species are involved. Therefore, the generic term Armillaria is used to refer to the group.

These fungi are natural components of forests, where they live on coarse roots and lower stems of conifers and broad-leaved trees. As parasites, the fungi cause mortality, wood decay, and growth reduction. They infect and kill trees that have already been weakened by competition, other pests, or climatic factors. The fungi also infect healthy trees, either killing them outright or predisposing them to attack by other fungi and insects.

Because these fungi commonly occur in the roots, their detection is difficult unless characteristic mushrooms are produced around the base of the tree or symptoms become obvious in the crown or on the lower stem. Crown symptoms on conifers vary somewhat, but typically consist of thin yellowing crowns, branch die-back, and reduced shoot and foliar growth. On large, lightly infected or fairly vigorous trees, crown symptoms develop over a number of years until the tree dies. Conifers, especially Douglas-fir, frequently produce a larger-than-normal crop of cones (stress crop), shortly before they die.

On small, extensively infected trees, crown symptoms develop rapidly: The foliage quickly discolors, and the trees (seedlings and saplings) often die within a year. On such trees, foliage loss and reduced shoot and foliar growth may not be noticed until tree death.

If armillaria is present, removing the bark covering infections will expose the characteristic white mycelial fan-shaped mats or root-like rhizomorphs that grow between the wood and the bark.

Trees of different species and sizes may be killed individually throughout stands. Armillaria kills trees, primarily conifers, in a pattern of progressively expanding disease centers. Armillaria may live for decades in coarse woody material. From this food base, the fungi spread to living hosts. Spread occurs when the rhizomorphs, growing through the soil contact uninfected roots or when uninfected roots contact infected ones. When infected live trees are cut, this disease rapidly spreads into the uncolonized parts of the roots and stumps. As a result, the food source increases and may be responsible for initiating new disease centers.

Outright mortality is the most frequently observed result of infection, which can be a problem in timber stands and recreation areas. Because decay extends only a few feet into the lower stem, it is often unnoticed until the tree fails or is cut. Tree failures can pose significant hazards in recreation areas.

Because these fungi are indigenous to many areas, exclusion is not feasible; management should be directed toward limiting disease buildup or reducing its impact. Cultural management shows promise for dealing with armillaria. Many of the considerations currently being applied in commercial forests can also be implemented in recreation areas. These include: (1) Maintaining vigorous tree growth without causing undue damage to soils (avoiding compacting soils), (2) minimizing stress to and wounding of high value trees, (3) reducing the food source by uprooting infected root systems and stumps when root disease-infected trees fail or are removed when they become a hazard to public safety and property, and (4) regenerating with less susceptible species.

Douglas-fir Dwarf Mistletoe, Arceuthobium douglasii & Southwestern Dwarf Mistletoe, Arceuthobium vaginatum subspecies cryptopodum.

Douglas-fir dwarf mistletoe (DFDM) and southwestern dwarf mistletoe (SWDM) are the most damaging diseases of Douglas-fir, Pseudotsuga menziesii, and ponderosa pine, Pinus ponderosa var scopulorum, respectively. Dwarf mistletoes (DM) are parasitic, seed-bearing plants that depend on their hosts almost completely for water and nutrients. The disease spreads by explosively released seeds which are expelled to distances ranging from 10 to 40 feet. Seeds of DFDM and SWDM are released in late July and early August. Infection follows a few months after dispersal, most taking place through the bark on needle-bearing portions of twigs. DMs first produce an endophytic system, a specialized root-like structure that is in contact with the phloem and xylem of host trees, from which the parasite obtains most of its nutrients and water. The aerial shoots appear between two to five years after infection; this period of infection before shoots are visible is known as the latent period.

The disease causes a decrease in the quality, quantity, and germination percent of seeds produced, lowers timber quality, reduces growth, and eventually leads to mortality in heavily infected trees. Severely infected trees are more susceptible to attacks by insects and other diseases and to environmental stresses such as drought. Heavily infected trees (DMR = 5 or 6) may sustain a 20 to 50 percent reduction in growth when compared to uninfected trees and their life expectancy is severely decreased (Lightle and Hawksworth, 1973). DM infects trees of all ages, thus, it is a problem in second growth and regeneration, as well as mature and overmature stands.

Spread of DFDM and SWDM is a function of stand density, age, and site index, and averages one to two feet a year. Spread is most efficient and rapid from an infected overstory to an understory and slowest through an evenaged stand. Management of DFDM and SWDM is directed toward decreasing spread and intensification of disease since DM eradication is achieved only by removing the entire stand of trees.

The following suggestions for DFDM and SWDM control in recreational forests are offered based on a 20 year study in Grand Canyon NP by Lightle and Hawksworth (1973):

-Pruning is recommended in lightly infected trees (DMR <3). Remove branches two whorls above highest DM-infected branch to insure against latent infections. No more than 50% of the live crown should be removed.

-Confine pruning to more isolated trees. Repruning has been required in densely stocked stands due to numerous latent infection in areas initially considered lightly infected.

-Infected branches should be cut off at the bole in order to insure removal of the endophytic, root-like, system in the host tissue.

-Trees with bole infections do not need to be killed since bole infections are not vigorous.

-Pruning witches brooms on heavily infected trees (DMR = 3-4) does prolong life. A shorter life expectancy corresponds to higher DMR.

Other management strategies include:

-Sanitize densely stocked stands. The most severely infected trees are removed to eliminate much of the inoculum and promote vigor of lightly and noninfected trees.

-Remove severely infected overstory trees. A vegetation management plan is desirable, with emphasis on nonhost species eventually replacing DM-infected trees.

-Apply ethylene-releasing chemicals to promote abscission of DM aerial shoots (Beatty, et. al., 1988; Nicholls, et. al., 1987). This method greatly reduces seed dispersal; the pathogen is not eliminated since the endophytic system remains viable within the host tissue and new aerial shoots form in two to five years. Chemicals need to be reapplied every few years, making this method suitable to high value areas where susceptible trees have been established under an infected overstory.

Western Spruce Budworm, Choristoneura occidentalis

The western spruce budworm (WSB) is a native insect occurring throughout the Douglas-fir, true fir, and mixed conifer forest cover types in the western United States. When at outbreak levels, the budworm is capable of causing considerable damages to commercially forested areas, developed recreation sites, and areas valued for their esthetic and scenic beauty.

Despite its name, the WSB feeds on and damages a variety of coniferous trees. Douglas-fir, true firs, and spruce are the primary host species in New Mexico. Budworm larvae, particularly in the mature stages feed almost exclusively on the new foliage of host trees. During periods of epidemic population levels,

these feeding larvae may consume nearly all the new needle growth, causing the tree crowns to appear scorched as if burned by fire. Several years of intensive feeding may result in trees being completely defoliated and appearing dead. Severe defoliation impacts the visual quality of the areas and causes growth loss, top-killing, tree mortality, and predisposes the highly stressed trees to bark beetle attack.

The budworm has one generation a year. Moth flight and mating generally occurs from late July through early August, after which the females begin laying eggs on the undersides of needles. Egg laying usually occurs from late July through mid-August. The eggs hatch in about ten days. The hatching caterpillars do not feed, but seek hiding places on limbs or the bole of host trees where they spin silken shelters (hibernacula) in which they hibernate during the winter. In the spring, the larvae begin mining the reproductive and vegetative buds and older needles and later begin feeding on the new foliage. The larvae, which mature in 30 to 40 days after attacking the buds, next pupate in silken webs at the last feeding site or elsewhere on the foliage. The pupal stage lasts about ten days after which the adult moth emerges.

Budworm populations are usually regulated by combinations of several natural factors such as insect parasites, vertebrate and invertebrate predators, and adverse weather conditions. However, the combined effect of natural agents does not prevent or reduce population resurgences when climatic and forest stand conditions are favorable for an increase in budworm populations. Conditions favoring budworm population buildups in the Southwest include extended periods of warm, dry weather during the spring and early summer months, and management practices that promote multistoried stands with a high percentage of budworm-preferred, shade tolerant species such as white fir and Douglas-fir. During prolonged outbreaks when stands become heavily defoliated, starvation can be an important mortality factor in regulating populations.

When necessary, WSB populations can be substantially reduced with insecticides. Large forested areas can be aerially sprayed for short-term protection and individual high value trees can be sprayed using ground spray equipment. However, the preferred management approach is through long-term silvicultural programs that facilitate a succession of vegetation favoring ponderosa pine, Douglas-fir, and aspen in vigorously growing even-aged stands. These stands should be noncontiguous and evenly distributed by age class.

MANAGEMENT ALTERNATIVES

1. Do nothing. Trees rated as potential hazards will continue to decline and the probability of failure will increase. Trees will continue to be damaged by campers and by natural causes, so the number of potential hazards will also increase. The possibility of tree failure with property damage and injury to people will increase. Aspens infected with canker diseases and trunk rots will continue to decline and eventually die. Dwarf mistletoe-infected trees will continue to decline in health and vigor and serve as inoculum for spread and intensification of the disease. Many of these trees may be predisposed to bark beetle attacks. Continued spread of armillaria root disease in Black Canyon and Redondo CGs may lead to increased tree mortality.

2. Remove hazard trees or lessen the probability of failure of hazard trees. This alternative would involve removing trees that have been identified as potentially hazardous. In many cases, pruning dead branches and large brooms would substantially reduce the probability of failure. The land manager must decide on an acceptable risk level and then remove the hazards until that

risk level is attained. Highest prioity should be given to the Category 1 trees (H/H) since they are the most prone to failure and present the greatest risk of personal injury and property damage. Trees with moderate and low failure ratings do not need immediate action, but should be monitored for changes over the years.

3. Remove hazard tree targets. Under this alternative, campgrounds or selected areas within campgrounds that are identified as targets are closed to public use. Removal of potential targets will remove the problem of hazard trees.

4. Develop a vegetation management plan based on objectives developed for the site, which reduces incidence of insect and disease and development of hazard trees. This may include activities such as: thinning dense stands of trees to reduce stress and the probability of bark beetle attack (for example, the densely forested mixed conifer areas in Clear Creek CG); sanitizing to decrease the incidence of DM-infection (Black Canyon and Redondo CGs); pruning DM-infected trees to prolong their life span near campsites and permanent structures or removing them completely (Black Canyon and Redondo CGs); and underplanting DM infected areas with non host species (Black Canyon and Redondo CGs); removing stumps with armillaria infections as armillaria infected trees die, (Black Canyon CG; etc.).

5. Erect Interpretive Signs. Because of the fragile nature of aspen bark and its susceptibility to trunk wounding and subsequent fungal infection in recreation areas, interpretive signs showing users why they should not injure tree trunks may be benificial in prolonging the life of these high value trees.

6. A combination of alternatives 2, 3, 4, and 5. These alternatives are not mutually exclusive and can be used in combination to solve specific problems in many areas.

ACKNOWLEDGEMENTS

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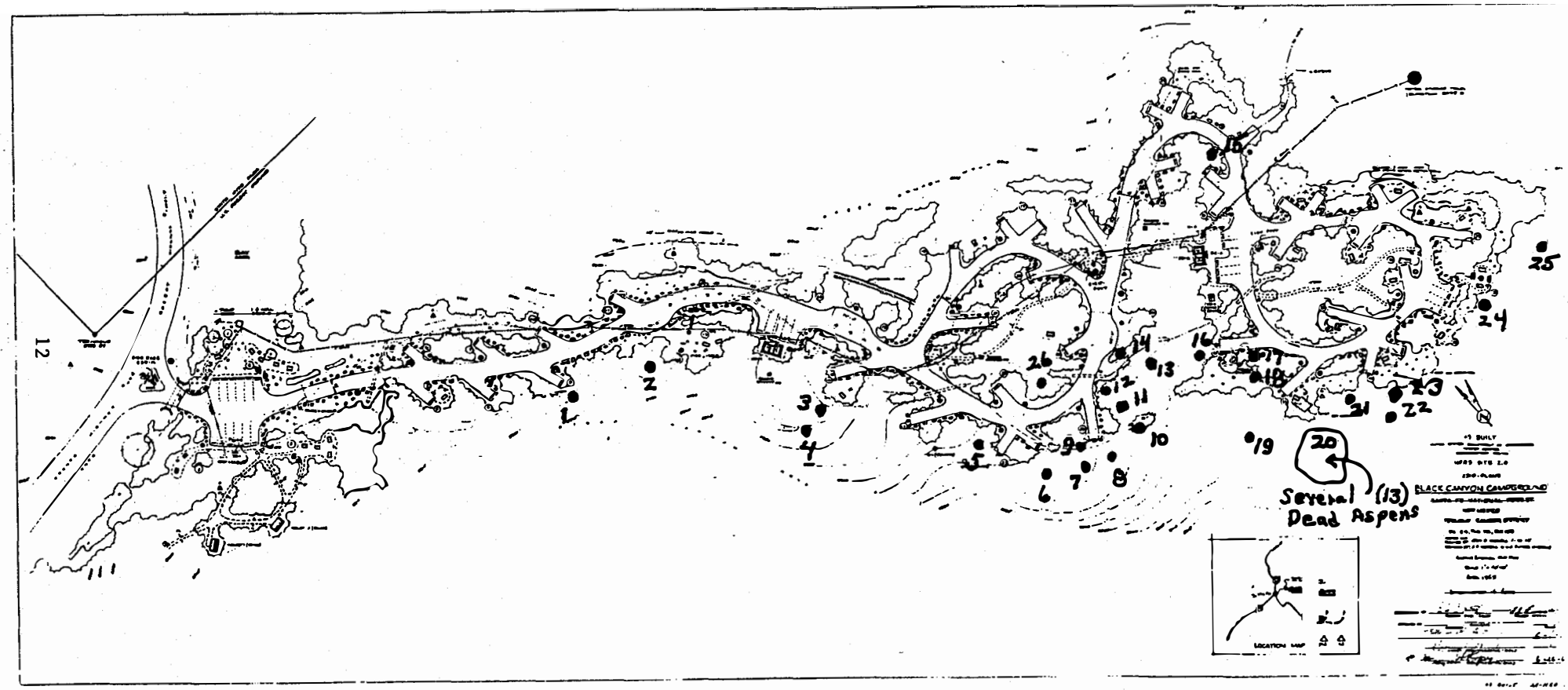
APPENDIX

Figure 1. Hazard Tree Survey Map
Black Canyon CG, Santa Fe
National Forest

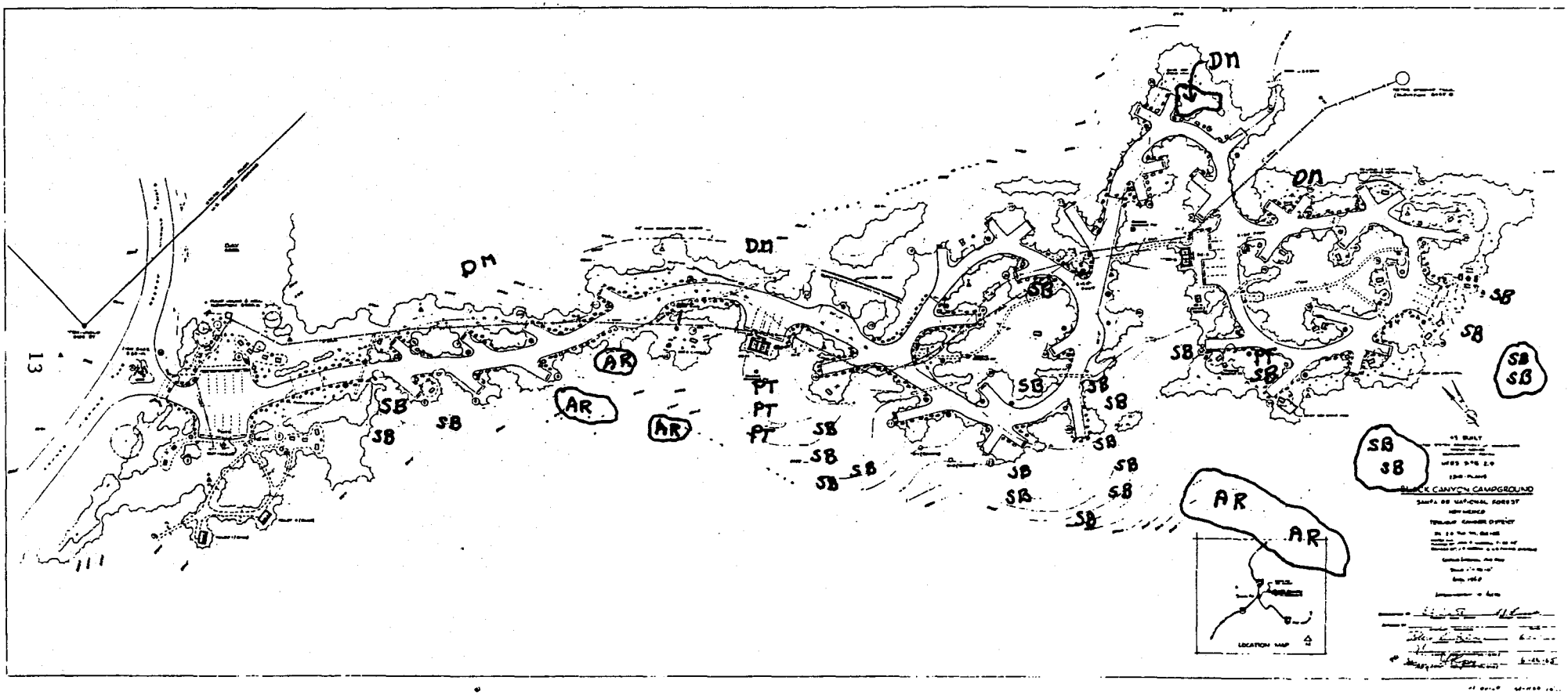


LEGEND

● - Hazard Tree

Figure 2.

Forest Pest Conditions Survey
Map, Black Canyon CG,
Santa Fe National Forest

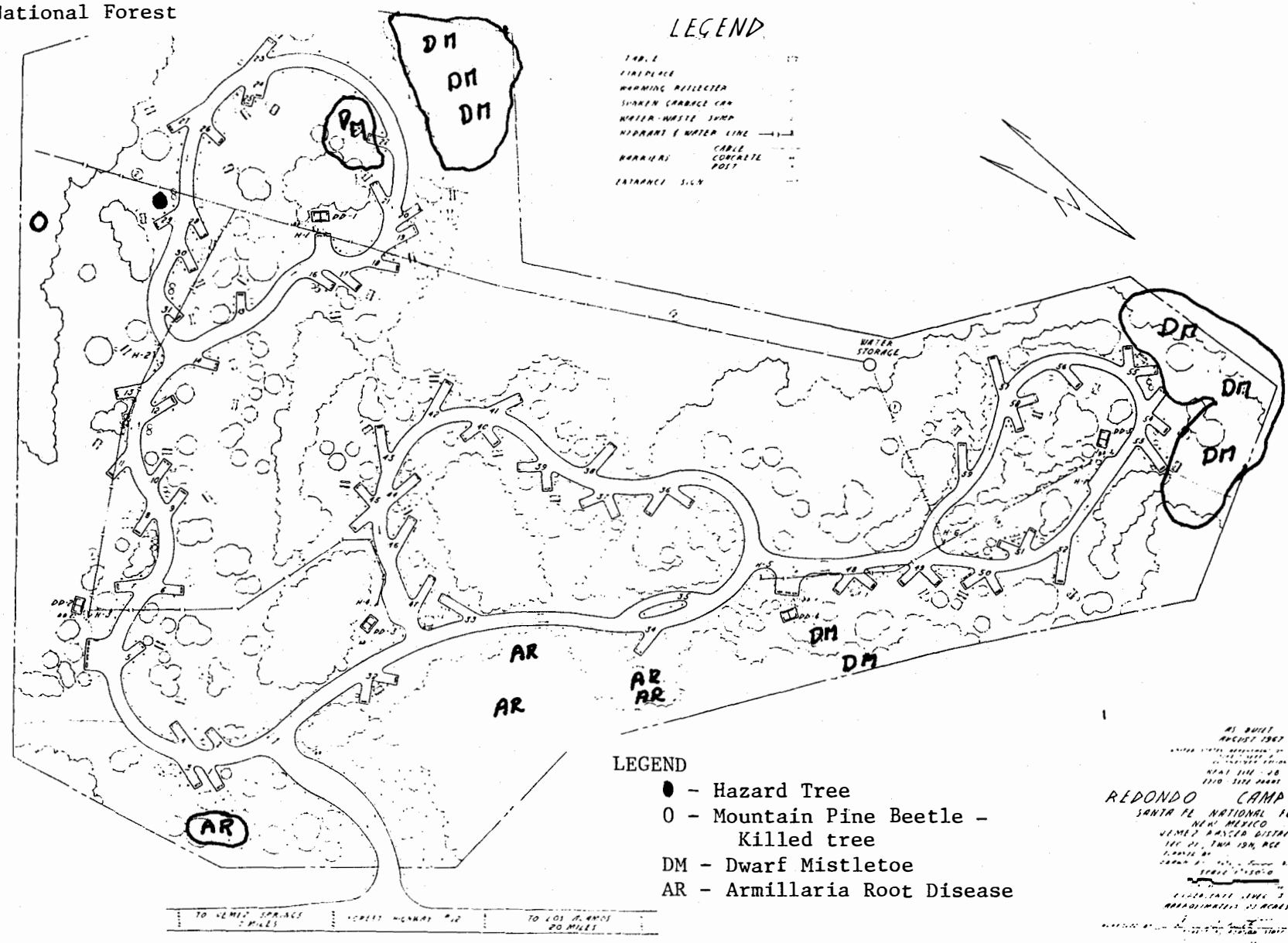


LEGEND

DM - Dwarf Mistletoe
SB - Sooty-Bark Canker
PT - Phellinus tremulae (Aspen trunk rot)
AR - Armillaria Root Disease

Figure 3

rd Tree and Forest Pest Conditions Survey Map, Redondo CG, Santa Fe National Forest



Figure

Hazard Tree Survey Map,
Rio Las Vacas CG, Santa Fe
National Forest

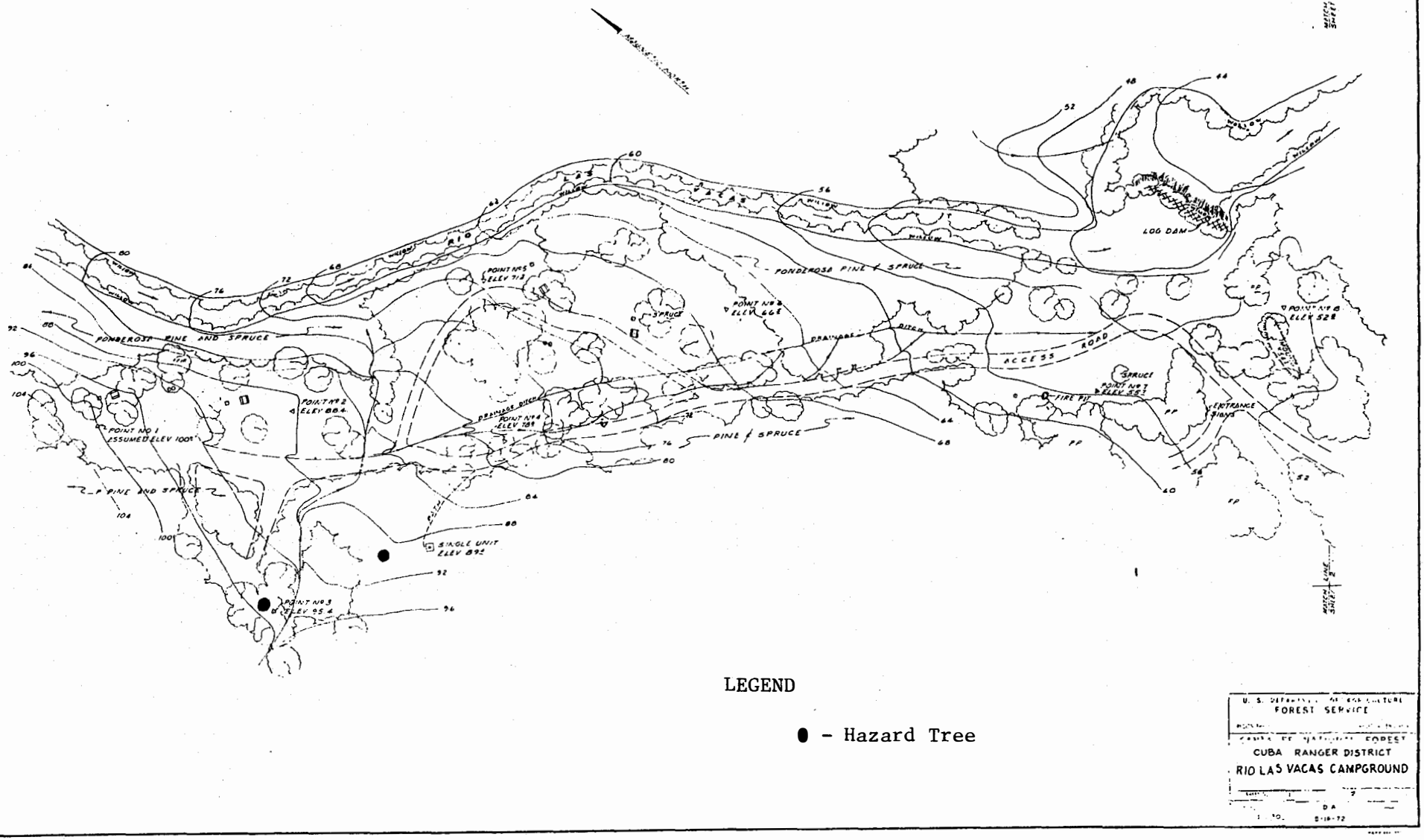
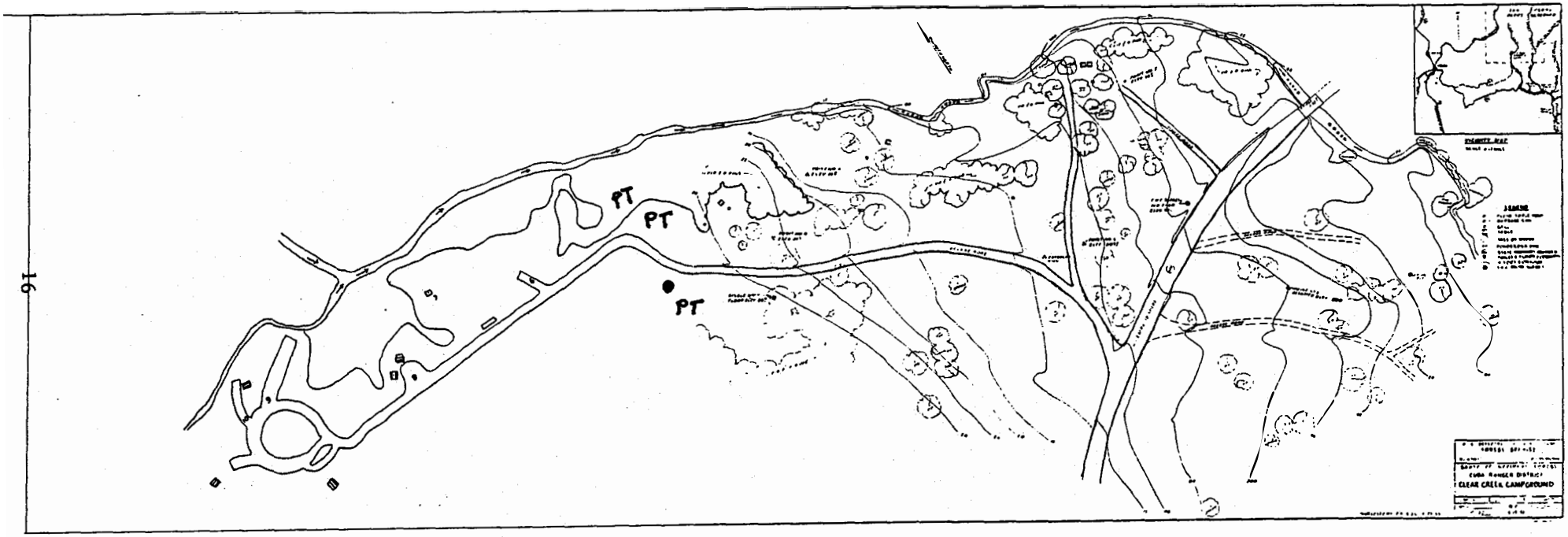


Figure 5.
Hazard Tree and Forest Pest Conditions Survey Map, Clear Creek CG, Santa Fe National Forest



LEGEND

● - Hazard Tree
PT - Phellinus tremulae (Aspen trunk rot)

TREE HAZARD EVALUATION

Administrative unit Espanola RD

Examined by PC, EJ

Site name Black Canyon C G

Date 8/11/89

Campground Unit No.	Pinic	Tree Location (azimuth and distance from fixed object)	Species	D.b.h.	*See Abbreviations Type of defect: Leaning (angle of lean)	Up-rooting, root rot, butt rot, basal cavity	Bole wounds, bole cankers, decay (conks)	Weak fork, limb defect, brooms, dead top	Potential targets: Permanent structure, parked vehicle, people	Permanent structure, high-use trails	Low-use trails, signs	Failure rating: High	Failure rating: Medium	Failure rating: Low	Risk rating: High	Risk rating: Medium	Risk rating: Low	Additional comments	Acti
		ABBREVIATIONS: TO=Toilet, TB=Table, FR=Fire ring, PP=Parking pad, TP=Tent pad, WH=Water hydrant, BG=Bridge, TC=Trash can, TD=Trailer dump																*DEFECT ABBREVIATIONS: RR=Root rot, BR=Bole or butt rot, BW=Bole wound, BC=Basal cavity, LD=Limb defect, WF=Weak Fork, C=Conk(s), DT=Dead top, ER=Exposed roots	
1		FR site 33, 186° 52'	WF	10.0	5°					X		X				X		DEAD	
2		FR site 30, 206° 74'	WF	5.1						X		X				X		DEAD	
3		TB site 29, 248° 37'	A	4.9					X			X				X		DEAD	
4		TB site 29, 220° 50'	A	7.1						X		X				X		DEAD, Leaning	
5		FR site 24, 327° 41'	A	5.7	25°				X			X			X			DEAD	
6		FR site 24, 170° 23'	A	9.1					X			X			X			DEAD	
7		FR site 23, 237° 52'	A	6.9					X			X			X			DEAD	
8		FR site 23, 216° 31'	A	11.3					X			X			X			DEAD	
9		FR site 23, 270° 35'	A	12.7					X			X			X			DEAD	

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Examined by PC, EJ

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10		FR site 23 20° 10'	A	12.2					X			X			X			DEAD	
11		FR site 23 350° 21'	A	8.8					X			X			X			DEAD	
12		FR site 23 337° 28'	A	9.4					X			X			X			DEAD	
13		FR site 23 21° 46'	A	8.1					X			X			X			DEAD	
14		FR site 23 270° 9'	A	5.7					X			X			X			DEAD	
15		FR site 17 70° 47'	A	5.4					X			X			X			DEAD	
16		FR site 12 221° 18'	A	8.8					X			X			X			DEAD	
17		FR site 12 66° 14'	A	9.1					X				X		X			BR	
18		FR site 12 92° 14'	A	7.3					X			X			X			DEAD	

TREE HAZARD EVALUA

Administrative unit Espanola RD

Examined by PC, EJ

Site name Black Canyon CG

Date 8/16/89

Campground Unit No.	Pic	Tree Location (azimuth and distance from fixed object)	Species	D.b.h.	*See Abbreviations Type of defect: Leaning (angle of lean)	Up-rooting, root rot, butt rot, basal cavity	Bole wounds, bole cankers, decay (conks)	Weak fork, limb defect, brooms, dead top	Potential targets: Permanent structure, parked vehicle, people	Permanent structure, high-use trails	Low-use trails, signs	Failure rating: High	Failure rating: Medium	Failure rating: Low	Risk rating: High	Risk rating: Medium	Risk rating: Low	Additional comments	Actio
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19		FR site 11 169° 65'	WF	9.5		X			X			X			X			DEAD	
20		Clump south of site 10	A	4-8			X			X		X				X		13 DEAD ASPENS SOUTH OF SITE 10	
21		FR-Site 7 287° 20'	WP	9.2		X			X			X			X			DEAD	
22		FR Site 7, 189° 5'	A	6.0	7°							X			X			DEAD	
23		FR site 7 99° 20'	A	7.2	15°						X	X					X	DEAD	
24		FR Site 7 52° 53'	A	5.7					X			X				X		DEAD	
25		FR site 6 44° 60'	A	12.6					X			X			X			DEAD	
26		TB site 25, 102° 21'	A	7.5					X			X			X			DEAD	

TREE HAZARD EVALUA

Administrative unit Jemez RD

Examined by PC, TR

Site name Redondo CG

Date 8/23/89

Campground Unit No.	Pic	Tree Location (azimuth and distance from fixed object)	Species	D.bh.	*See Abbreviations Type of defect: Leaning (angle of lean)	Up-rooting, root rot, butt rot, basal cavity	Bole wounds, bole cankers, decay (conks)	Weak fork, limb defect, brooms, dead top	Potential targets: Permanent structure, parked vehicle, people	Permanent structure, high-use trails	Low-use trails, signs	Failure rating: High	Failure rating: Medium	Failure rating: Low	Risk rating: High	Risk rating: Medium	Risk rating: Low	Additional comments	Actio
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1	FR site 46, 150° 41'	PP	225	10°				X			X			X			DEAD	

TREE HAZARD EVALU

Administrative unit Cuba RD

Examined by PC, EJ

Site name Rio Las Vacas CG

Date 8/1/89

Campground Unit No.	Pic	Tree Location (azimuth and distance from fixed object)	Species	D.b.h.	Leaning (angle of lean)	*See Abbreviations Type of defect: Up-rooting, root rot, butt rot, basal cavity	Bole wounds, bole cankers, decay (conks)	Weak fork, limb defect, brooms, dead top	Potential targets: Permanent structure, parked vehicle, people	Permanent structure, high-use trails	Low-use trails, signs	Failure rating: High	Failure rating: Medium	Failure rating: Low	Risk rating: High	Risk rating: Medium	Risk rating: Low	Additional comments	Actio
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		FR site 5,																	
1		146° 78'	BS	5.9	38°	X			X			X			X			DEAD.	
2		247° 72'	DF	5.0	46°	X					X	X			X			DEAD	

TREE HAZARD EVALUA

Administrative unit Cuba RD

Examined by PC, EJ

Site name Clear Creek CG

Date 8/1/89

Campground Unit No.	Pic	Tree Location (azimuth and distance from fixed object)	Species	D.bh.	*See Abbreviations Type of defect: Leaning (angle of lean)	Up-rooting, root rot, butt rot, basal cavity	Bole wounds, bole cankers, decay (conks)	Weak fork, limb defect, brooms, dead top	Potential targets: Permanent structure, parked vehicle, people	Permanent structure, high-use trails	Low-use trails, signs	Failure rating: High	Failure rating: Med	Failure rating: Low	Risk rating: High	Risk rating: Med	Risk rating: Low	Additional comments	Actic
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1		Fire Ring Site S 285° 200'	A	14.0		X				X			X			X		BW, C	